Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	RM-10740
Rulemaking under Part 97 of	)	
The Communications Act of 1934 (sic)	)	
As amended to Establish Technical	)	
Standards for Certain Amateur	)	
Radio Telephony Transmissions	)	

Comments by Donald B. Chester

23 July, 2003

To: The Commission:

Introduction

The petitioners seek to amend Part 97 of the rules to limit SSB radiotelephony (type J3E emission) to a maximum of 2.8 kHz bandwidth, and double-sideband AM radiotelephony (type A3E) to a maximum of 5.6 kHz bandwidth, on any amateur frequency below 28.8 mHz. The petitioners allege that two groups of amateurs regularly adjust or misadjust their transmitters to occupy more bandwidth than necessary. One group is alleged to purposely adjust their transmitters to cause splatter in order to give themselves "elbow room" during contests, while the other group is alleged to generate "extremely wide" signals while experimenting with high-fidelity audio using the single-sideband mode. The petitioners claim that a "*de facto*" bandwidth standard for amateur SSB of about 3 kHz exists, and request to impose "*de jure*" standards by including specific bandwidth limits in Part 97 rules.

I am submitting comments to explain why the petitioners' arguments are unpersuasive, the proposal is without merit, and why the Commission should summarily dismiss this petition in its entirety.

1. The general standards set forth in Section 97.101 of the rules are sufficient and specific bandwidth limits would be contrary to the basis and purpose of amateur radio as defined in Section 97.1.

With the present generalised telephony allocation ("phone") as defined in Section 97.3 (c) (5), specifications for distinction of the sub-categories of the various modulation schemes are not necessary. One of the unique features of the Amateur Radio Service is the wide choice of emissions and operating frequencies available for communication, experimentation and self-instruction in the radio art. The standards set forth in Section 97.101 have been deliberately left vague, in order to allow the maximum flexibility of operation under a wide variety of circumstances in the multi-faceted pursuit that is amateur radio. This is consistent with Section 97.1 (b), (c) and (d), which state that the rules are designed to promote the amateur's ability to

contribute to the advancement of the radio art, to provide for advancing skills in both the communications and technical phases of the art, and to expand the existing reservoir of trained operators, technicians and electronics experts.

The reference to *communication quality* phone emissions in Section 97.307(f)(2) is a perfect example of the Commission's conscious effort to avoid specific figures in the wording of its rules regarding emission standards. The purpose of this reference is to define a non-specific bandwidth standard for non-phone emissions such as image, which may be multiplexed with voice by independent sideband or other means. There is nothing in this section to imply that the audio quality of all amateur radio phone transmissions must be limited to that of the land-line telephone or less.

2. Existing rules sufficiently address the misconduct the petitioners allege has occurred on the amateur bands. Section 97.101 (a) states "In all respects not specifically covered by FCC Rules each amateur station must be operated in accordance with good engineering and good amateur practice". 97.101(b) states that amateur operators must "cooperate in selecting transmitting channels and in making the most effective use of …frequencies." 97.101(c) states that "No amateur operator shall wilfully or maliciously interfere with or cause interference to any radio communication or signal." Operators who deliberately cause their transmitters to splatter to drive other operators away from their frequency are in violation of both 97.101(a) and 97.110(c). Those who repeatedly and consistently cause harmful interference to others with excessively wide sidebands while using or experimenting with high quality audio, may be in violation of 97.101(a) and 97.101(b), even if their transmitter is otherwise clean and free from spurious distortion products. However, it must be remembered that amateur radio is a multi-faceted pursuit, no-one has any prior claim to any specific frequency, and all amateur communication operates on an interference-expected basis. In other words, no-one is guaranteed a clear channel. Furthermore, it would be difficult to determine when one amateur's routine, non-emergency communication is more important than another's experimental transmission. The most satisfactory solution when incidents of interference occur is for one or both operators to choose a different operating frequency, per 97.101(b).

The petitioners claim that the ambiguity of the present rules due to the lack of "*de jure*" bandwidth limitation makes enforcement difficult. However, specific bandwidth limits would have to be clearly defined in technical terms, and would require considerable expense and expertise on the part of the individual operator in order to use appropriate test equipment to assure that his/her transmitter is in compliance. Due to inherent characteristics of amateur communication and HF propagation, it would be difficult for the Commission to enforce such limits without actual on-premises inspection of the station. It is doubtful that the Commission would find internal disputes within the amateur community, that result in interference that does not extend outside the amateur frequency allocations, of sufficient importance to regularly perform such inspections. Therefore, it is highly unlikely that specific bandwidth limits as requested by the petitioners would significantly improve interference conditions on the phone frequencies in the amateur HF spectrum.

3. The proposed bandwidth limits would discourage home construction and modification of transmitting equipment, stifle experimentation with amateur voice transmission, and would render many existing transmitters obsolete.

Under the present rules, transmitting bandwidth is loosely defined in Section 97.307(a): "No amateur station transmission shall occupy mere bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice." This makes a clear distinction between bandwidth due to the frequency range of the modulating signal and bandwidth due to spurious distortion products. The rules allow operators the option of limiting the highest modulating frequencies during voice transmission so as to accommodate the traffic load on a given amateur voice band at the time. For example, when there is very light activity, as typically exists on the 1.8 mHz band during daylight hours, there would be no reason to prohibit amateurs from transmitting full fidelity voice signals with a frequency response of 20 to 20,000 Hz. Using double sideband transmission, this signal would occupy a total bandwidth of up to 40 kHz. But if there are few, if any other stations using the band, this signal would cause no harm to anyone. Yet, to transmit the same signal in the 3.5 or 14 mHz band during prime propagation periods on a weekend when the band is heavily congested, would be extremely poor amateur and engineering practice, and the operator could be cited for a rules violation. The present rules allow the individual amateur to use good judgement in choosing the characteristics of the modulating signal. This freedom of choice would be lost if rigid, one-size-fits-all specific bandwidth limits were imposed. The petitioners argue that those who insist on occupying unusual amounts of spectrum could operate above 28.8 Mhz. It can be assumed that amateurs communicating or carrying out over-the-air experimentation would be engaged in two-way conversations. During much of the solar cycle, ionospheric propagation will be absent on those frequencies, so such operation would usually be limited to cases where two or more amateurs with similar interests happened to live within a few miles of each other.

One of the problem groups cited by the petitioners is alleged to have transmitted inappropriately wide signals while engaged in *experimentation* with high quality SSB voice transmission. Technical experimentation is fundamental to the basis and purpose of amateur radio as defined in Section 97.1. A frequently heard complaint within the broadcast industry is the dearth of engineers and technicians qualified to maintain broadcast facilities. Few electronics vocational schools offer in-depth courses that include hands-on experience with high power transmitters and audio techniques, but amateur radio is an excellent avenue for gaining experience in this field. Among the few remaining groups of amateurs who still build, modify and experiment with transmitting equipment are those who operate AM phone, and more recently, high quality SSB. This is precisely the kind of self-instruction in the radio art that is referred to in Section 97.1 (c) and (d), but would be discouraged by the proposed bandwidth limitations.

Some examples of useful experimentation involving high quality SSB may include, but are not limited to the following: (1) investigation of the optimum compromise between readability, voice quality and channel bandwidth under the wide variety of conditions normally encountered on the HF amateur bands, including varying levels of interference, natural atmospheric and manmade noise, signal strength and congestion under heavy, moderate and light band occupancy; (2) investigation of the effects of nominal bandwidth, phase shift distortion,

passband ripple and skirt selectivity of analogue sideband filters; (3) examination of the effects of artefacts resulting from digital sideband filters and digital speech processors (DSP).

Throughout the history of amateur radio use of SSB, there has been very little investigation of topics such as those described above.. The standard voice quality has been highly restricted telephone-quality "communications" audio, which has given SSB the reputation of having a scratchy, tinny, unnatural sound. This is often the result of using narrow sideband filters, severely restricted audio modulating bandwidth and allowing substantial waveform distortion, with little regard for voice quality, regardless of band conditions. Many persons have described typical SSB audio voice quality as irritating and annoying, often generating "listener's fatigue" after more than a few minutes of hearing amateur SSB transmissions. The present operation is the first widespread attempt in the amateur community to develop more acceptable SSB audio quality. Transmitting with the minimum possible bandwidth may be one worthwhile endeavour, but this is not the sole objective of amateur radio experimentation.

Strict bandwidth limits would inhibit home construction of amateur transmitting equipment, since many would-be builders may lack the test equipment and expertise to feel confident that their construction projects would be in compliance with a specific bandwidth rule. This would further encourage the nearly exclusive use of factory produced transceivers, and even discourage amateurs from attempting to repair their own commercially built transmitting equipment. As explained earlier, this would be contrary to the basis and purpose of amateur radio as defined in Section 97.1.

4. The proposed bandwidth limits of 2.8 kHz for single-sideband and 5.6 kHz for double-sideband are unrealistic. Many existing SSB transmitters use standard mechanical or crystal bandpass filters with bandwidths as high as 3.1 kHz to generate SSB. Older units that use the phasing method of SSB generation may lack any sharp-cutoff filters whatever. AM (A3E) transmitters may lack sharp cutoff low pass audio filters in the speech amplifier circuit. The proposed bandwidth limits could render much of the older equipment used by amateurs obsolete. Even some recently manufactured SSB transceivers have the capability of variable audio frequency response, allowing audio tones of up to 6 kHz to be transmitted. Limiting the upper frequency range of transmitters to 2.8 kHz may substantially reduce voice intelligibility since frequencies containing most of the sibilants would be filtered out. It has even been suggested that such a legal bandwidth limit could be irreconcilable with the Americans with Disabilities Act, since certain forms of hearing-impairment may preclude the comprehension of speech that has severely limited high-frequency response.

The proposed bandwidth limits fail to take into account one inherent difference between single and double sideband transmission. With SSB, a typical telephone-quality voice signal with 300-3100 Hz frequency response would occupy 2.8 kHz of bandwidth, since suppressing the lower audio frequencies also reduces the total bandwidth of the signal. With double-sideband, limiting the lower audio frequencies does nothing to reduce bandwidth, because the total bandwidth is twice the *highest* modulating frequency. For equitable limitation of the two modes, the DSB bandwidth limit would be approximately 3.1 kHz to correspond to a SSB limit of 2.8.

It appears likely that the petitioners' bandwidth figures of 2.8/5.6 kHz are based on the 2.8 kHz bandwidth restriction imposed on the five newly-allocated voice channels for amateur use in the vicinity of 5 mHz. According to the Report and Order, the primary government users operate on channels spaced in three kHz increments, and the amateur allocation was restricted to upper-sideband with this bandwidth limit in order to make amateur operation compatible with the government band plan and to avoid channel overlapping, as provided by the NTIA in allowing amateur operation on those frequencies. The bandwidth standard was not imposed on this secondary amateur allocation for reasons cited by the petitioners in the present proceeding.

5. The petitioners offer no justification for imposing specific bandwidth limits to A3E (full-carrier double sideband amplitude modulation). See paragraph 2.2, page 3 of RM-10740: "…To the petitioners' knowledge, AM operators have not purposely tried to broaden their signals. Use of AM, while growing again in popularity, does not create the same problems that the burgeoning use of so-called 'Hi-Fi Single Sideband' creates…" Nevertheless, the petitioners go on to request a "*de jure*" bandwidth limit of 5.6 kHz for this mode, despite their own admission that the alleged problems they are attempting to address have involved SSB operation but not AM. The petitioners do not request a similar bandwidth limit for narrowband frequency modulation (F3E), another form of "phone" permitted below 28.8 mHz, nor do they petition for "*de jure*" bandwidth limitations for other modes of emission permitted on the HF bands. They offer no explanation why A3E should be singled out for bandwidth limitation in addition to SSB, where the alleged problem lies.

6. Poor audio quality has flawed the public's perception of amateur radio. An article appeared on in our local newspaper (*The Leaf Chronicle*, 22 July 2003, Clarksville, TN). The writer is Paul Davidson of USA TODAY. I am quoting a portion of the article as an example of the non-amateur public's perception of amateur radio, which has resulted largely from the distortion and restricted frequency response typical of "communications quality" SSB audio. The topic of this article is free and reduced price telephone service via the internet.

…There was initial concern... noting the dubious quality and reliability of Net calling in the late 1990's. But, (now) quality is phenomenal, and it's very cost effective.

Until about 18 months ago, Internet calls meant tinny, ***ham-radio like*** connections over PC microphones and speakers (emphasis mine). Calling on the Net largely was the province of hobbyists who gladly put up with the jittery voice quality for the chance to beat the system, make free calls and cultivate a pioneering spirit.

But technological advances and broadband's growth have made calls on the Net, or Internet-like private networks, roughly equivalent to traditional phone service...

Thus, the author implies that typical amateur radio voice quality (exemplified in HF SSB) is expected to be substantially inferior to that of the standard landline telephone. This has undoubtedly contributed to the present-day interest in high-quality single-sideband.

7. By the petitioners' own admission, the stated goals and objectives of "hi-fi audio SSB" experimentation include clean signals as free of spurious distortion products as

possible, utilising a minimum of bandwidth. Exhibit II, page 10 of RM-10740 includes the following excerpts from the "Hi-Fi Audio SSB" website:

"…even though a perfect reproduction of our voices would be ideal, it isn't going to happen because of our limited bandwidth… the best we can do is manipulate the audio in such a way as to keep the audio as rich and full as we can… The SSB "mid-fi" station sounded excellent! Not exactly like AM broadcast, but closer than the typical SSB audio without being a full 6 kHz wide. In fact, this station was about 3.5 kHz wide. More importantly, the station was clean with excellent carrier suppression and extremely low (Inter-modulation Distortion) products. This actually contributes to less bandwidth than some stations running a 2.4 kHz bandwidth with poor I.M.D., sometimes making them as much as 10 kHz wide."

For the record, my own amateur radio operation does not include the transmission of "hi-fi SSB." I primarily operate DSB AM (A3E) and CW (A1A). My AM operation shares many of the same goals as "hi-fi SSB," that is, good voice quality and a clean signal and bandwidth appropriate to band conditions. My AM transmitters are home constructed using the best quality parts available, largely salvaged from discarded broadcast equipment. The circuits are conservatively designed, and particular attention has been paid to making the audio sections as distortion free as possible. I use a combination of two microphones properly in phase with the outputs combined in a home-constructed audio mixer. The total frequency response of the speech amplifier and modulator is essentially flat from 40 Hz to over 10,000 Hz. I use a switch-able array of low-pass audio filters with the following choices of cutoff characteristics: (1) extremely sharp cutoff beginning at 3400 Hz and more than 25 dB down at 3600 Hz; (2) more gradual cutoff beginning at 5 kHz and more than 25 dB down at 7.5 kHz; and (3) no filter at all. In addition, I use a pre-emphasis circuit that begins to boost audio frequencies at approximately 800 Hz with a steadily rising characteristic to about 10 decibels of boost at 2000 Hz, and flat beyond that frequency. Under congested band conditions I always use the 3400 Hz cutoff. The pre-emphasis seems to compensate for the lack of highs beyond 3400 Hz, giving the audio a balanced sounding tone. I often get reports of "broadcast quality" using this setup. Under light band congestion, I sometimes switch to the 5000 Hz filter, with reports of improved audio. I rarely operate without one of the filters in the circuit. It has been my experience that under congested band conditions, the 3400 Hz cutoff does not significantly degrade voice quality because most operators are using a receiving bandwidth of 6 kHz or less, so the audio frequency components above 3400 Hz would not be heard and would only contribute to needless bandwidth and interference to adjacent channels.

Regardless of how well the audio response of a transmitter is filtered, there will inevitably be some distortion products beyond the normal signal passband, which may be heard by other operators when the signal is exceptionally strong. For example, the spurious products may be suppressed by 40 dB, unquestionably an example of good engineering practice, but if the signal is received at a level of 40 dB above a reference of S9, the spurious products will still be audible in the receiver at an S9 signal level. This does not include additional distortion products that may be generated within the receiver, especially when receiving strong signals.

8. Errors in this petition as it is written cast doubt on the petitioners' qualifications to initiate a rulemaking proceeding. In paragraph 4.0 of RM-10740, the petitioners state: "…For those transmitters that would not meet the standard, a simple 'high pass' audio circuit could be installed between a microphone of a station and the microphone input..." Since the total bandwidth of a signal is a function of the *highest* modulating frequency, a *low pass* filter would be needed for this purpose. An audio filter in the microphone circuit would do nothing to

eliminate spurious distortion products that appear within the wider passband of the sideband filter in the transmitter, or those that appear in subsequent power amplifier stages. Many of the transmitters in present use in the amateur service would have to be extensively modified in order to comply with the proposed rules, or taken off the air.

The petitioners claim to be proposing changes to the rules under *Part 97 of the Communications Act of 1934, as amended*. This shows a gross misunderstanding of how the various radio services are governed by the Federal Communications Commission. Only the U.S. Congress has the authority to make changes to the Communications Act. Part 97 refers to administrative rules set up by the Commission as provided under the Communications Act.

These errors indicate either that this petition was prepared and executed in extreme haste and that the petitioners did not even take the trouble to proofread the document before it was submitted, which is incredulous given the extensive attention to details contained therein, or that the petitioners are profoundly lacking in technical knowledge related to the art of radio and in legal knowledge related to how the radio services in the United States are regulated.

Conclusion

The proposal to impose specific bandwidth limits on type A3E and type J3E emission in the amateur radio bands below 28.8 mHz would not be in the public interest. It would stifle home construction and experimentation and render much of the existing equipment used by amateurs obsolete. Amateur HF voice communication would be limited to low-quality signals with impaired intelligibility. Amateur operators would find it difficult to assure that their transmitters would be in compliance, and the Commission would find it difficult to enforce the rule. The rule would serve no useful purpose, since it would likely result in little, if any improvement in the congested condition of certain amateur voice frequencies, and any improvement is speculative at best. The proposals in RM-10740 are totally lacking in merit and I respectfully urge that this petition be dismissed in its entirety.

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